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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

PETTITT, JOHN F

ART UNIT PAPER NUMBER

3744

DATE MAILED: 08/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/825,884	Applicant(s) LE METAIS, MARC	
	Examiner John Pettitt	Art Unit 3744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 6-17 is/are rejected.
- 7) ☒ Claim(s) 5 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>20060810</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

The disclosure is objected to because of the following informalities:

Though it is true that the circuits 43 and 43' cool the main refrigerant in the main refrigerant circuit (thus pre-cooling the main refrigerant in the main refrigerant circuit), the use of the term "pre-cooling" (on page 13, lines 29, 36; page 14, lines 3, 7, 9, 17, 22, 26, and 33) causes confusion with the pre-cooling circuit (3). Therefore, the examiner suggests using --additional-- when referring to the components of circuits (43) and (43') at any time in the specification.

Page 10, line 25 refers to "hot side" which should be --hot sides--.

Appropriate correction is required.

Claim Objections

Claims 1-2, 4, 5, 8, 10, 12, and 13 are objected to because of the following informalities:

In regard to claim 1,

- A. The recitation "the heat exchanger" (line 7) should be replaced with --the pre-cooling heat exchanger-- to avoid confusion with the main heat exchanger.

- B. The recitation "this circuit" (line 18) should be replaced with --said additional circuit-- to avoid confusion with the main and pre-cooling refrigeration circuits.

In regard to claim 4, the recitation "a heat exchanger" (line 2) should be replaced with --the main heat exchanger-- as it is clear from the specification that the heat exchangers participating in each of the additional refrigerant circuits are the main heat exchangers recited in claim 3 lines 8-10.

In regard to claim 5, the recitation "a heat exchanger" (line 2) should be replaced with --the main heat exchanger-- as it is clear from the specification that the heat exchangers participating in each of the additional refrigerant circuits are the main heat exchangers recited in claim 3 lines 8-10. In addition, the recitations "said heat exchanger" in lines 9 and 10 should also be replaced with --said main heat exchanger--.

In regard to claim 8, the recitation "a heat exchanger" (line 2) should be replaced with --the pre-cooling heat exchanger-- as it is clear from the specification that the heat exchanger participating in the pre-cooling refrigerant circuit is the pre-cooling heat exchanger introduced previously in claim 1 (line 2).

In regard to claim 10, the recitation "(vii)" is incorrect as there is no (vi) within claim 1. Therefore, --(vi)-- should be used.

In regard to claim 12,

- A. The recitation "one heat exchanger" (lines 5-6) should be replaced with --the main heat exchanger-- as it is referred to as "the main heat exchanger" later in claim 12, (lines 11-12).

- B. The recitation “the heat exchanger” (lines 7-8) should be replaced with --the pre-cooling heat exchanger-- to avoid confusion with the main heat exchanger.
- C. The recitation “the natural gas” (line 10) should be replaced with --the pre-cooled natural gas-- to avoid confusion with the natural gas stream entering the pre-cooling heat exchanger.
- D. The recitation “in” (line 18) should be replaced with --using-- to clearly indicate that the additional circuit performs the step of removing heat from the main refrigerant in the main refrigerant circuit.
- E. The recitation “the main refrigerants” (line 20) should be replaced with --main refrigerant-- as there are not plural “main refrigerants” involved in the process claim.

In regard to claim 13,

- A. The recitation “the natural gas” (line 14) should be --the pre-cooled natural gas-- to avoid confusion with the natural gas stream entering the pre-cooling heat exchanger.
- B. The recitation “in at least two additional circuits” (lines 23-24) should be replaced with --using at least two additional circuits-- as it is clear from the disclosure that the additional circuits are being used to remove heat from the main refrigerants, while “in” creates confusion as to what is “in” the additional circuits.

C. The recitation "the natural gas" (line 28) should be corrected as stated in 13(A) above.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 8, and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Stockmann et al. (US 6,253,574 B1).

In regard to claim 1, Stockmann et al. ('574) teach a liquefaction plant comprising one pre-cooling heat exchanger (E1); one main heat exchanger (E2); one main refrigerant circuit (L components, Figure 1); a pre-cooling refrigerant circuit (P components, Figure 1); one additional circuit (S components) that is separate from the pre-cooling refrigerant circuit (P components) and the main refrigerant circuit (L components) is separate from the pre-cooling refrigerant circuit (P components).

In regard to claim 2, Stockmann et al. ('574) teach the additional circuit comprises a heat exchanger (E3), a compressor (S3); a cooler (S4); an expansion device (S10); a conduit (arrow between compressor (S3) and cooler (S4)) connecting the outlet of the compressor (S3) with the cooler (S4); a return conduit (S11 and S2)

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connecting the outlet of the cold side of the heat exchanger (E3, the third arrow from the left to the right) with the inlet of the compressor (S3).

In regard to claim 8, Stockmann et al. ('574) teach the pre-cooling refrigerant circuit comprises a heat exchanger (E1); a compressor (P3); a cooler (P4); an expansion device (P13); a conduit (arrow between compressor (P3) and cooler (P4)) connecting the outlet of the compressor (P3) with the cooler (P4); a return conduit (P14 and P2) connecting the outlet of the cold side of the heat exchanger (E1, the fifth arrow from the left to the right) with the inlet of the compressor (P3).

In regard to claim 10, Stockmann et al. ('574) teach a pretreatment downstream of the pre-cooling heat exchanger for removing the heavy components from the gas (Column 5, Lines 37-48).

Claims 1, 12, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Low (US 5,473,900).

In regard to claim 1, Low ('900) teaches a plant for liquefying natural gas comprising one pre-cooling heat exchanger (30); one main heat exchanger (34); one main refrigerant circuit (26); a pre-cooling refrigerant circuit (24); one additional circuit (28) that is separate from the pre-cooling refrigerant circuit (24). Additionally, the main refrigerant circuit (26) is separate from the pre-cooling refrigerant circuit (24).

In regard to claim 12, Low ('900) teaches a process for liquefying natural gas comprising

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- 1) Pre-cooling natural gas in a pre-cooling heat exchanger (30); (column 3, lines 36-37)
- 2) Liquefying the pre-cooled natural gas in one heat exchanger (34); (column 3, lines 40-42)
- 3) Removing heat from the natural gas using a main refrigerant circuit (26); (column 3, lines 42-46)
- 4) Removing heat from the natural gas in the pre-cooling heat exchanger (30) using a pre-cooling refrigerant circuit (24); (column 3, lines 36-37)
- 5) Removing heat from the main refrigerant in the main refrigerant circuit (26) using one additional circuit (28), (column 3, lines 42-46)
 - a. wherein step 5 is separate from step 4 and
 - b. wherein step 4 does not make use of the main refrigerant circuit. In light of the applicant's disclosure, the phrase, "does not make use of said refrigerant circuit" is interpreted to mean that the main refrigerant circuit is not used in the pre-cooling heat exchanger to cool the natural gas.

In regard to claim 16, Low ('900) teaches the process of claim 12 carried out in a plant that meets the limitations of claim 1.

Claim 13 is rejected under 35 U.S.C. 102(b) as being anticipated by Klein Nagel Voort (US 6,389,844 B1). Klein Nagel Voort ('844) teaches a process for liquefying natural gas comprising pre-cooling natural gas in a pre-cooling heat exchanger into a flow of pre-cooled natural gas (column 3, lines 50-64); distributing said flow of pre-cooled

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natural gas into two distributed pre-cooled flows (column 3, lines 65-67); liquefying the two disturbed pre-cooled gas flows in two main heat exchangers each comprising a first hot side having one inlet receiving one distributed pre-cooled gas flow and an outlet for liquefied natural gas (column 3, lines 65 - column 4, line 1); removing heat from the natural gas flow through the first hot side of the corresponding main heat exchanger using two main refrigerant circuits (column 4, lines 7-24); removing heat from the natural gas in the pre-cooling heat exchanger using a pre-cooling refrigerant circuit (column 3, lines 51-62); removing heat from the main refrigerants in each of the main refrigerant circuits using two additional circuits where the step of removing heat from the pre-cooled natural gas in step (iv) does not make use of the main refrigerant circuits; (column 3, line 51- column 4 line 24) and finally, removing heat from the main refrigerants wherein this step is separate from the step of removing heat from the natural gas in the pre-cooling (column 4, lines 7-24). One of ordinary skill in the art would interpret the phrase “where the step of removing heat from the main refrigerants is separate from the step of removing heat from the natural gas in step (v)” to mean that the heat exchange occurs separately; which heat exchange does occur separately in Klein Nagel Voort ('844).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 4, 6, 7, 9, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the obvious modification of Klein Nagel Voort (US 6,389,844 B1).

In regard to claim 3, Klein Nagel Voort ('844) teaches a liquefaction plant comprising a pre-cooling heat exchanger (15); a distributor (4); two main heat exchangers (5 and 5'); two main refrigerant circuits (cooling the natural gas streams 25 and 25'); a pre-cooling refrigerant circuit (cooling the natural gas through heat exchange in heat exchanger 15); and that the main refrigerant circuits are separate from the pre-cooling refrigerant circuit.

Klein Nagel Voort ('844) does not teach that the two additional circuits (which cool the main refrigerants in the main refrigerant circuits) are separate from the pre-cooling refrigerant circuit. However, propane is commonly used as the pre-cooling refrigerant in pre-cooling refrigerant circuits (see, for example, Klein Nagel Voort ('844) -column 4, lines 25-31) as the boiling point of propane is relatively high. Therefore, one of ordinary skill in the art would have recognized that the condensation of the main refrigerants in the main refrigerant circuits (via heat exchangers 58 and 58') could be done more effectively (i.e. equivalent heat transfer with smaller heat exchangers (58 and 58') or higher flow rates with larger heat exchangers) by separating the two

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additional refrigerant circuits from the pre-cooling refrigerant circuit and charging the additional refrigerant circuits with a lower boiling point refrigerant. Another obvious benefit of this modification is that the refrigerant used in the main refrigerant circuit could then have a lower heat rejection temperature and a lower refrigeration temperature, which would lead to higher heat transfer rates within 5 and 5'.

In regard to claim 4, Klein Nagel Voort ('844) teaches that the additional circuits each comprise a heat exchanger (58 and 58'); a compressor (50 and 50'); a cooler (56 and 56'); and an expansion device (45 and 45'). The inlet of the compressor (50 and 50') is connected to the outlet of the cold side of the heat exchanger (58 and 58') by return conduit (46 and 46'). The outlet of the compressor (50 and 50') is connected to the inlet of the cooler (56 and 56'). The conduit (44 and 44') extends via the expansion device (45 and 45').

In regard to claim 6, Klein Nagel Voort ('844) teaches an integrated heat exchanger (102) in Figures 2 and 3. Though, Klein Nagel Voort ('844) teach that the integrated heat exchanger (102) is used for cooling the main refrigerants (57 and 57') and pre-cooling the natural gas in (12), one of ordinary skill in the art would recognize that the natural gas tube (12) could be excluded from the integrated heat exchanger (102) and used in the combination discussed above for claim 3. The integration of the heat exchangers (58 and 58') into one heat exchanger (102) still provides Voort's ('844) intended benefit of reducing the number of circuit components (and therefore the capital costs of the plant).

In regard to claim 7, Klein Nagel Voort ('844) teaches the plant comprises two main heat exchangers (5 and 5'); two main refrigerant circuits, and two additional circuits (Figure 1).

In regard to claim 9, Klein Nagel Voort ('844) teaches the pre-cooling refrigerant circuit comprises a heat exchanger (15); a compressor (31); a cooler (36); and an expansion device (38). The inlet (33) of the compressor (31) is connected to the outlet (40) of the cold side of the heat exchanger (15) by return conduit (41). The outlet (34) of the compressor (31) is connected to the inlet of the cooler (36). The conduit (line connecting outlet of cooler and the inlet of the heat exchanger (15)) extends via the expansion device (38).

In regard to claim 17, the process of claim 13 is an obvious process to carry out in the plant described for the rejection of claim 3. The process is not more limiting than basic operation of the plant described for the rejection of claim 3.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over the obvious modification of Klein Nagel Voort (US 6,389,844 B1) as described for claim 3 above and further in view of Roberts et al. (US 6,308,531 B1). Though the obvious modification of Klein Nagel Voort ('844) meets all the limitations of claim 3, Klein Nagel Voort ('844) does not teach a pretreatment downstream of the pre-cooling heat exchanger.

Roberts et al. ('531) teach a pre-treating scrub column (108, column 8, lines 6-16) for removing the heavy components from the pre-cooled natural gas. Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was

made, to combine the liquefaction system taught by Klein Nagel Voort ('844) with the pretreatment described by Roberts et al. ('531) for the purpose of removing unwanted components in the pre-cooled natural gas stream so that the final liquefied natural gas is sufficiently free of contaminants as required by the consumers of the liquefied natural gas.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Low (US 5,473,900) as described for claim 12 above and further in view of Roberts et al. (US 6,308,531 B1). Though Low ('900) teaches all the limitations of claim 12, Low ('900) does not teach pre-treating the pre-cooling natural gas.

Roberts et al. ('531) teach the step of pre-treating the flow of pre-cooled natural gas for removing part of the heavy components from the gas (scrub column 108, column 8, lines 6-16). Therefore, it would have been obvious to combine the steps described by Low ('900) above with the step of pretreatment described by Roberts et al. ('531) for the purpose of removing unwanted components in the pre-cooled natural gas stream so that the final liquefied natural gas is sufficiently free of contaminants as required by the consumers of the liquefied natural gas.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Klein Nagel Voort (US 6,389,844 B1) as described for claim 13 above and further in view of Roberts et al. (US 6,308,531 B1). Though the obvious modification of Klein Nagel Voort ('844)

meets all the limitations of claim 3, Klein Nagel Voort ('844) does not teach pre-treating the pre-cooled natural gas.

Roberts et al. ('531) teach the step of pre-treating the flow of pre-cooled natural gas for removing part of the heavy components from the gas (scrub column 108, column 8, lines 6-16). Therefore, it would have been obvious to combine the steps described by Klein Nagel Voort ('844) as described above for claim 13 with the step of pretreatment described by Roberts et al. ('531) for the purpose of removing unwanted components in the pre-cooled natural gas stream so that the final liquefied natural gas is sufficiently free of contaminants as required by the consumers of the liquefied natural gas.

Allowable Subject Matter

Claim 5 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Pettitt whose telephone number is 571-272-0771. The examiner can normally be reached on M-F 8a-4p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl Tyler can be reached on 571-272-4834. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JFP III


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